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ABSTRACT

The purpose of this exploratory case study is to examine the relationship of internal motivational factors (personal relevance to learning, self-efficacy beliefs about learning, and goal-orientations for learning) and students' engagement in science learning. Five academically at-risk girls were interviewed for the study. Descriptions of learning engagement were elicited with respect to three separate learning contexts relevant to the adolescent's life: science class a favorite class and an extracurricular activity. An additional data source included teacher surveys detailing observations of student engagement in the science classroom. Cross-case analysis of the three international motivational factors was used to examine their effects across the learning contexts. From the girls' voices emerge common themes, reflecting the centrality of self in relation to learning across all contexts: who I am, who I am becoming, and the importance of relationships. Using internal motivational factors as organizing concepts, patterns of learning engagement are described. One pattern represented characteristics of extracurricular engagement and two patterns represented science engagement. Extracurricular engagement revealed a model of persistent engagement with study participants describing key elements of global efficacy beliefs, rich learning and mastery goal-orientations, and ways that the activities are personally relevant. Three of the five girls interviewed describe similar characteristics in science engagement. Models of learning engagement are proposed and comparisons among patterns of engagement reveal the significance of personal relevance and learning that is integrated with the girls' identity development. This paper emphasizes part of these engagement patterns--how science is personally relevant to the girls' lives. The girls describe how their sense of who they are, who they are becoming, and the importance of relationships is central to how they relate to science and what they learn. Their descriptions highlight entry points for engaging in learning science and potential ways science learning can be both meaningful and sustained over time. The study concluded that students who describe personal relevance, but who focus less on extrinsic goals are more likely to characterize their learning as integrated with their identities. Furthermore, they describe engaging in science as a means for learning more about themselves. This study has implications for educational research and pedagogical practice in terms of conceptualizing multiple ways at-risk girls

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Engagement in Science Learning Among Academically At-Risk Girls: Sense of Self and Motivation to Learn Across Learning Contexts

American Education Research Association, New Orleans, 2002

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Abstract

The purpose of this exploratory case study is to examine the relationship of internal motivational factors (personal relevance to learning, self-efficacy beliefs about learning, and goal-orientations for learning) and students' engagement in science learning. I interviewed five academically at-risk girls. Descriptions of learning engagement were elicited with respect to three separate learning contexts relevant to the adolescent's life: science class, a favorite class, and an extracurricular activity. An additional data source included teacher surveys detailing observations of student engagement in the science classroom. Cross-case analysis of the three internal motivational factors was used to examine their effects across the learning contexts.

From the girls' voices emerge common themes, reflecting the centrality of self in relation to learning across all contexts: *who I am, who I am becoming, and the importance of relationships*. Using internal motivational factors as organizing concepts, I describe patterns of learning engagement; one pattern represents characteristics of extracurricular engagement and two patterns represent science engagement. Extracurricular engagement reveals a model of persistent engagement with study participants describing key elements of global efficacy beliefs, rich learning and mastery goal-orientations, and ways that the activities are personally relevant. Three of the five girls describe similar characteristics in science engagement. Models of learning engagement are proposed and comparisons among patterns of engagement reveal the significance of personal relevance and learning that is integrated with the girls' identity development.

This paper emphases part of these engagement patterns—how science is personally relevant to the girls' lives. The girls describe how their sense of who they are, who they are becoming, and the importance of relationships is central to how they relate to science and what they learn. The girls' descriptions highlight entry points for engaging in learning science and potential ways science learning can be both meaningful and sustained over time. Students who describe personal relevance but who focus less on extrinsic goals are more likely to characterize their learning as integrated with their identities. Furthermore, they describe engaging in science as a means for learning more about themselves.

This study has implications for educational research and pedagogical practice in terms of conceptualizing the multiple ways at-risk girls find science relevant and building motivation to learn science.

Introduction

Studying engagement in science offers a different perspective than what we as educators typically observe. There is a tendency to see failing students as not motivated to do anything, or only motivated to

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get the task done or receive a grade that is just passing; we see students who seem disinterested and seem like they couldn't care less about science or school in general. What we do not see are the moments in which a connection to science learning occurs and worse we may be missing the antecedents to engaging in science. Additionally we fail to see outside of the science classroom to the multiple ways in which students are motivated and interested in learning. This study offers a glimpse of these moments in these girls lives and tells a story about their motivation to learn in an unlikely setting.

Engaging students in the sciences is a critical challenge for educators. The *National Science Education Standards* (National Research Council, 1996), the *Benchmarks for Science Literacy* (American Association for the Advancement of Science, AAAS, 1993) and *Science for All Americans: Project 2061* (AAAS, 1989) advocate that *all* students can learn science and that science should be made more accessible to all students. Despite reform efforts, national studies show that the U.S. educational system is failing to educate all students in science (National Education Goals Panel, 1995; American Association of University Women, AAUW, 1992). While the number of women in science is increasing, studies indicate that girls are less likely to take science classes beyond basic school requirements, and, when girls are in science classes they are less likely to be engaged in the learning process (Aikenhead, 1998; AAUW, 1992; Moffat, 1992; Tobin, 1988). Thus, this is a critical time to work toward the inclusion of all students and particularly girls in the sciences (National Council for Research on Women, NCRW, 2001).

Of concern are students who are academically at-risk[1] for dropping out of school. These students experience repeated failures in school, are difficult to engage academically, and are at risk of falling further behind (Tobias, 1992). For these girls, engaging in science might not fit with their perceptions of themselves, their lives outside of school, or their personal, family, or cultural beliefs (Barton & Yang, 2000; Brickhouse, Lowery, & Schultz, 2000; Parsons 1997). Indeed science might be a "world apart" from their day-to-day lives (Costa, 1995). If there is a strong disassociation between self and engaging in the learning process, learning will have little intrinsic value.

A clear research priority is to understand in what ways at-risk girls can be effectively engaged in learning science. While motivational research generally focuses on ways students *fail to engage* in learning, in this study I focus on motivational factors influencing how at-risk girls do *engage* in learning. This exploratory study examines what it means to be engaged in learning from the perspective of girls who have a history of failure in the sciences. Specifically, engagement in learning science is investigated in terms of personal motivational attributes. The central research question addressed in this study is: *How do academically at-risk girls' internal motivational factors (personal relevance to learning, self-efficacy beliefs about learning, and goal-orientations for learning) relate to their engagement in science learning and other learning contexts?*

In this paper, I begin with background on engagement and motivation among at-risk girls and the development of this study. I then describe patterns of engagement within extracurricular activities and science activities. Within these patterns, a few critical elements are highlighted, illustrating salient themes of identity and how identity is important to engagement. This study is a preliminary step in a program of research systematically studying how to increase at-risk girls' science engagement.

Background

Much is known about how at-risk youth disengage from school (Cothran & Ennis, 2000; Finn, 1989; Wehlage, Rutter, Smith, Lesko, & Fernandez, 1989) but little is known about ways in which they do engage. Yet, engagement is known to be a prerequisite for academic success (Cothran & Ennis, 2000; Montgomery & Rossi, 1994; Newmann, Wehlage & Lamborn, 1992; Steinberg, 1996; Tobin & Capie, 1982) as well as school retention of at-risk youth (Montgomery & Rossi, 1994). Placing an emphasis of study on engagement and motivation shifts a traditional focus on academic achievement to *processes* involved in learning. This shift may be a particularly important for students who are labeled with low grades but who may hold little value for grades or school routines in general. Thus studying girls'

engagement sheds light on learning process not usually observed when measuring singular outcomes such as grades.

Few studies have examined ways in which motivation is important to at-risk youth engaging in science learning. Some studies have addressed the relationship between motivational factors (e.g. goal-orientations and beliefs) and science engagement (Ainley, 1993; Lee & Anderson, 1993; Lee & Brophy, 1998). But few researchers have examined this relationship with at-risk youth. In the at-risk literature, researchers have attempted to characterize motivational factors for at-risk youth (Huang & Waxman, 1996; Nunn & Parish, 1992; Strahan, 1988). But few researchers have examined motivation in the context of engagement (Cothran & Ennis, 2000; Finn, 1989). For example, studies have found that at-risk students tend to have low achievement motivation, low efficacy beliefs, low expectations for success, and express few intrinsic desires to succeed by earning good grades (Huang & Waxman, 1996; Nunn & Parish, 1992; Strahan, 1988). While this information is meaningful in identifying characteristics of at-risk youth, it does not adequately describe driving forces for engagement in learning.

Student perspectives are needed to begin to understand the relationship between motivational factors and engagement in learning. Not surprisingly, little is known about science engagement from the student perspective, particularly the perspective of at-risk girls in the sciences. Examining student perspectives provides a window for understanding how students do and can engage in learning science (Cothran & Ennis, 2000; Davis, 1997; Shapiro, 1989).

Engagement is a term that attempts to capture the essence of motivated, directed learning. Engagement in a task, a topic, an activity, a conversation, can be viewed as a potential drive for meaningful learning and developing learning habits. This study focuses on academic engagement and the term "engagement" is taken to mean the thoughts, feelings, and behaviors associated with "the student's psychological investment in and effort directed toward learning, understanding, or mastering the knowledge, skills, or crafts that academic work is intended to promote (Newmann et al., 1992, p. 12)." Newmann and his colleagues clarify their view of engagement in academic work by stating that it is more than a commitment to complete assignments and get good grades. Moreover, they recognize that engagement does not necessarily mean engagement in meaningful learning. Consistent with this idea, studies have shown that engagement can involve an investment in performing routine tasks in the *absence* of substantive understanding or intrinsic investment in learning (Eckert, 1989). However, engagement in academic work (especially work assigned by teachers) might not be the same as engagement in learning both inside and outside of school. It is possible that at-risk students engage in learning but not in the actual tasks assigned.

Studying motivation within the context of engagement has the potential to reveal insights into how girls who have experienced repeated failure in science can overcome barriers and learn science that is personally meaningful. Motivation research considers self-factors, such as student perceptions, beliefs, and goals central to engagement in learning (Lee & Anderson, 1993). Examining disengagement from this frame, emphasizes how girls' engagement may be *limited* by their negative attitudes toward science (Simpson & Oliver, 1985), unproductive goal orientations such as work-avoidant or social involvement goals that are counterproductive to task engagement (Ames & Archer, 1988), low self-efficacy (Bandura, 1997), or lack of experiencing task relevance (Shernoff et al., 2001; Tobin & Capie, 1982).

For this study three factors typically considered important to student disengagement, are considered in relation to academic engagement: (1) personal relevance of learning, (2) self-efficacy beliefs about learning, and (3) goal-orientations for learning. This paper emphasizes one motivational factor, personal relevance of learning. I selected this element as an emphasis because it best illustrates ways in which the girls chose to engage in science and how learning science is important to their identity development.

The ways in which students relate to the activity they are learning can be described in terms of *personal relevance to learning*. Not finding relevance to a subject is one factor thought to lead to disengagement among at-risk youth (Cothran & Ennis, 1999). Few studies have examined the relationship between the degree to which students see science tasks as relevant and engagement in learning. Recently, however, some studies have addressed how related constructs such as future goals,

career goals, and interests influence engagement (Covington & Wiedenhaupt, 1997; Hidi, 1990; McEvoy & Covington, 2001; Shernoff, Schneider, and Csikszentmihalyi, 2001). Both personal goals and interests are considered as related constructs to personal relevance because they describe potential ways students can relate to what they are learning.

Future goals (in terms of anticipated and valued distance consequences) influence persistence of learning (Covington & Wiedenhaupt, 1997; Shernoff et al., 2001). Students are more likely to maintain enthusiasm and experience greater perceived skill, challenge, concentration, and enjoyment when they find the material relevant to their life outside of the classroom or relevant to their career goals (Covington & Wiedenhaupt, 1997; Shernoff, et al., 2001). Thus not only does there appear to be a link between future goals and engagement but also having future goals may be important to sustaining engagement.

Similarly, students are more engaged when the material relates to personal interests (Hidi, 1990; McEvoy & Covington, 2001). Some students remain enthused about learning if they view the material as applicable to their interests *despite* experiencing poor grades. While studies have not examined the significance of personal relevance to engagement, some studies have generally implicated the importance of personal relevance for at-risk youth (Cothran & Ennis, 1999; Newmann et al., 1992; Strahan, 1988). This study is a preliminary step for understanding ways in which relevance is significant for at-risk girls in the sciences.

Methods

Academically at-risk girls represent a population that science educators fail to reach in the classroom because we lack adequate and sufficient knowledge to support these youths' learning. To address the research question and provide insight into engagement in science learning for at-risk girls I chose a case study approach (Merriam, 1998; Yin, 1993). Case studies are useful "to gain an in-depth understanding of the situation and meaning for those involved" (Merriam, 1998, p.19; Yin, 1993, p.46). This study was conducted over a period of one month and focused on three factors relevant to learning engagement: (1) personal relevance of learning, (2) self-efficacy beliefs about knowledge, skills, and learning, and (3) goal-orientations for learning. Selection of these factors was informed by a review of the literature and themes that emerged from pilot study in which I used a grounded approach. Focus was placed on collecting and analyzing data in a targeted fashion based on these factors.

Selection of Cases/ Participants

All five of the students interviewed attended a public high school in a large metropolitan city in the Pacific Northwest. The school enrolls over 1,500 students, representing multiple racial backgrounds. An Internal Review Board approved this study prior to selecting participants.

For this study, academically at-risk students[2] were selected based on previous failure in science courses, and current poor performance and attendance in science. Connell and Wellborn (1991) use core academic subject failure (including failure in science) and attendance as two of their indicators for identifying academically at-risk students. Two science teachers were asked to use purposeful selection (Denzin & Lincoln, 1994; Merriam, 1998), to identify female students struggling in biology based on the following criteria: (1) failure in first semester biology, *and* (2) consistently poor school attendance and/or poor grades, or a sudden drop in attendance or grades. Teachers distributed consent forms to students who expressed interest in participating.

I interviewed five girls: Beth, Mica, Thalia, Crystal, and Rosa[1]. Four of the participating students were sophomores and one was a junior. Each failed first semester science class. Mica and Rosa were placed in a remedial science class and Beth, Thalia, and Crystal continued into the sequel biology course for the second semester of the academic year. Student data collected from teachers and a school counselor are summarized in Table 1 below. Qualitative interview data also supports the girls' selection as academically at-risk students; the girls discuss effects of failure on their lives and low efficacy beliefs in school related settings (Strahan, 1988; Tobias, 1992).

Table 1
Student Data.

Name	Ethnicity	Grade Level	GPA (4.0 scale)	Previous Science Class/ Grade	Current Science Class/ Grade
Beth	Caucasian	10th	1.9	Biology/ F	Biology II/ D
Mica	Asia-American	10th	2.5	Biology/ F	General Science/ C
Thalia	Caucasian	10th	2.3	Biology/ F	Biology II/ D
Crystal	Caucasian	11th	2.8	Biology/ F	Biology II/ D
Rosa	Latina- American	10th	2.7	Biology/ F	General Science/ B

Data Collection

The interviews took place in the school library in May and June 2001 for approximately two hours total (there were two interviews each lasting about one hour). I used a semi-structured interview to pose open-ended questions (Rossman & Rallis, 1998; Rubin & Rubin, 1995) specifically including questions about their engagement in *three learning contexts*: science class, extracurricular activities, and a favorite class.

In this study engagement was defined as the behaviors associated with "the student's psychological investment in and effort directed toward learning, understanding, or mastering the knowledge, skills, or crafts" (Newmann et al., 1992, p. 12). Specifically I probed for descriptions of engagement exhibiting behaviors requiring time, effort, commitment, and concentration (Freese, 1999; Newmann et al., 1992). If the students' examples of a time when they were engaged did not meet these criteria, other examples were explored.

To explore internal motivational factors, I asked questions about personal relevance of their learning (Cipriani-Sklar, 1997; Helms, 1998; Hidi, 1990), self-efficacy beliefs about their learning (Anderman & Young, 1994; Bandura, 1997; Hogan, 1998; Miller et al., 1996; Nunn & Parish, 1992) and their specific goal-orientations for learning (Ainley, 1993; Ames & Archer, 1988; Hogan, 1998; Lee & Anderson, 1993; Miller et al., 1996; Murphy & Alexander, 2000; Wentzel, 1991). Protocol questions were adapted from motivation scales, other qualitative studies, and my pilot study.

In the second interview I asked additional questions specific to the science learning context. I asked about their beliefs about science, their beliefs about the general significance of science, and how they viewed learning in science in comparison to a student they defined and described as a "good science student."

All questions from the protocol were asked, and I used additional probes (Merriam, 1998; Rubin & Rubin, 1995) and follow-up questions (Rossman & Rallis, 1998; Rubin & Rubin, 1995) to elicit more examples and detailed responses, and to question incongruent statements. Student responses were audio taped and later transcribed. I recorded summary memos and field notes highlighting initial thoughts on salient themes (Clandinin & Conniley, 2000; Merriam, 1998; Rossman & Rallis, 1998) after the interviews, which I used to reflect upon and inform my interview and observational practice.

Additionally I collected data from the girls' science teachers. A teacher survey was used to elicit responses describing the ways in which they saw the students engaging in science during class.

Analytic Methods

While collecting the data, I used ongoing content analysis and analytic induction (Merriam, 1998) with the transcripts, memos from the interviews, field notes and interim texts (Huberman & Miles, 1994). I used category construction (Merriam, 1998) and a pattern clarification cross-case analysis (Huberman & Miles, 1994) to derive themes across individuals. Specifically I examined themes within and across the three engagement contexts (science class, extra-curricular activity, and favorite class) relating to internal motivational factors (personal relevance, self-efficacy, and goal-orientation).

Themes from this analysis were considered in reference to existing motivational literature (Murphy & Alexander, 2000). Themes from this analysis also were verified with a triangulation of the

data sources (Janesick, 1994). Specifically I compared teacher notes describing when the students were engaged to the girls' descriptions their engagement. The same criteria used to identify student engagement in the interviews were used to identify engaging situations described by the teachers. The data from the students' science teachers were used in comparison to student self-reports. Peer examination was also used to scrutinize themes and conclusions derived from the data (Merriam, 1998).

I first describe themes that emerged within extracurricular and science learning contexts, and report these as patterns of engagement. I then describe themes that span the motivational categories I investigated and describe their salience within the girls' description of how they related to science. Comparisons of themes across the girls are presented in the Discussion.

Patterns of Engagement

There are patterns in the ways the girls describe engaging in science and other learning contexts that describe the intersections of the three internal motivational engagement factors explored in this study. The scale of this study precludes generalizing these patterns to all at-risk girls in the sciences or even to these girls at all times in the sciences. However, examining the patterns of their reported engagement provides a starting place to better understand characteristics important to science engagement. I have represented characteristics of their motivation and engagement in an extracurricular context and within science as *patterns of engagement*. From their words one pattern of extracurricular engagement and two patterns of science engagement can be described. Within these patterns, characteristics of three overlapping motivational factors are described (personal relevance, efficacy/ability beliefs, and goal orientations). Additionally I describe frequencies of engagement and characteristics of what the girls report learning when they are engaged. These patterns illustrate the complexity of factors important to engagement and serve as a backdrop for discussing the centrality of identity to engagement later in this paper.

Extracurricular engagement (Figure 1). In their extracurricular contexts, the girls describe engaging in activities such as sports, after-school acting classes, and photography. When describing their extracurricular engagement, the girls describe (1) three types of personal relevance, (2) global level of self-efficacy beliefs, and (3) rich learning and mastery goal-orientations. Furthermore, each girl reports learning skills, values, and beliefs that are integrated with her sense of self.

Science engagement (Figures 2 & 3). In comparison to their engagement in extracurricular *contexts*, in science the girls describe engaging in specific *tasks*. The girls describe singular times they engaged in science as compared to the many times and many types of activities in extracurricular activities. In science, two patterns of engagement emerge. The patterns are similar in terms of efficacy beliefs; all girls describe specific-level efficacy beliefs when engaged and an overall low perception of their ability in science. However, the patterns differ in terms of how the girls describe personal relevance, goal-orientations, and the characteristics of what they learned.

In the first pattern, *Integrated Science Engagement*, Beth, Mica, and Thalia describe personal relevance to science. They describe the science task as relating to their beliefs and values, to their future goals and careers, or to relationships with others. They describe learning goals in terms of an intrinsic desire to learn and an intrinsic willingness to learn more. Moreover, each girl reports learning science skills, values, and beliefs that are integrated with her sense of self.

In the second pattern, *Impersonal Science Engagement*, Crystal and Rosa do not describe personal relevance to the science task but rather a *situational interest* in the task. They also describe both intrinsic and extrinsic learning goal-orientations; they describe learning for understanding as well as for earning good grades to impress their families. While they report learning science skills and beliefs applicable to specific tasks in science, it is not integrated with each girl's sense of self.

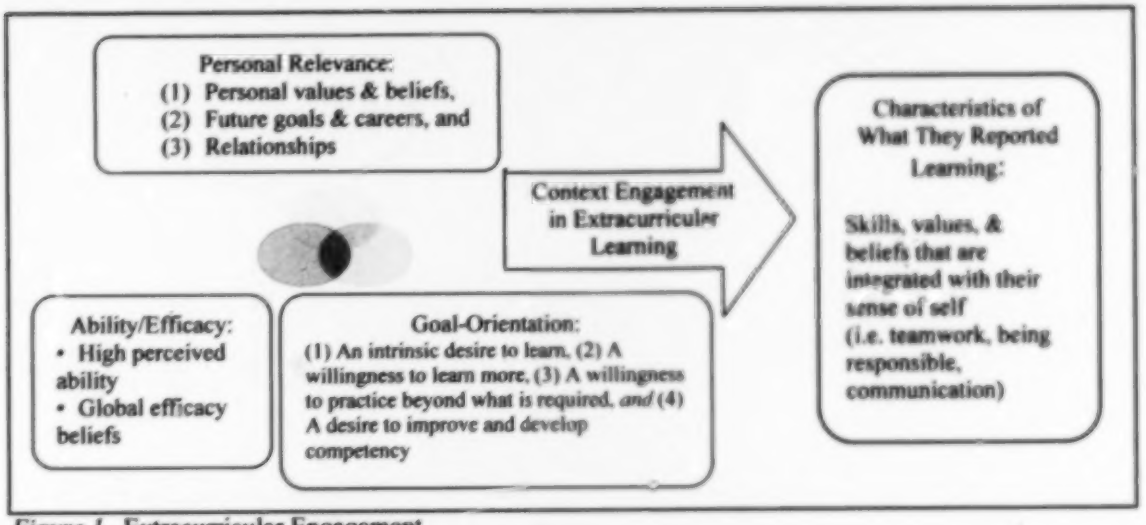
Personal Relevance:
(1) Personal values & beliefs,
(2) Future goals & careers, and
(3) Relationships
Context Engagement in Extracurricular Learning
Characteristics of What They Reported Learning:
Skills, values, & beliefs that are integrated with their sense of self (i.e. teamwork, being responsible, communication)
Ability/Efficacy:
• High perceived ability
• Global efficacy beliefs
Goal-Orientation:
(1) An intrinsic desire to learn, (2) A willingness to learn more, (3) A willingness to practice beyond what is required, and (4) A desire to improve and develop competency

Figure 1. Extracurricular Engagement.

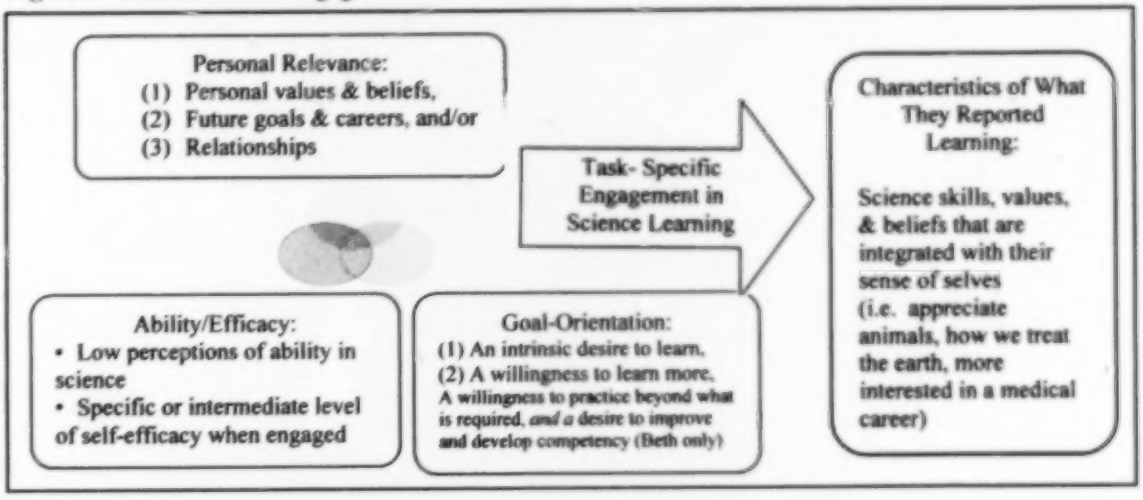
Personal Relevance:
(1) Personal values & beliefs,
(2) Future goals & careers, and/or
(3) Relationships
Task- Specific Engagement in Science Learning
Characteristics of What They Reported Learning:
Science skills, values, & beliefs that are integrated with their sense of selves (i.e. appreciate animals, how we treat the earth, more interested in a medical career)
Ability/Efficacy:
• Low perceptions of ability in science
• Specific or intermediate level of self-efficacy when engaged
Goal-Orientation:
(1) An intrinsic desire to learn,
(2) A willingness to learn more,
A willingness to practice beyond what is required, and a desire to improve and develop competency (Beth only)

Figure 2. Integrated Science Engagement.

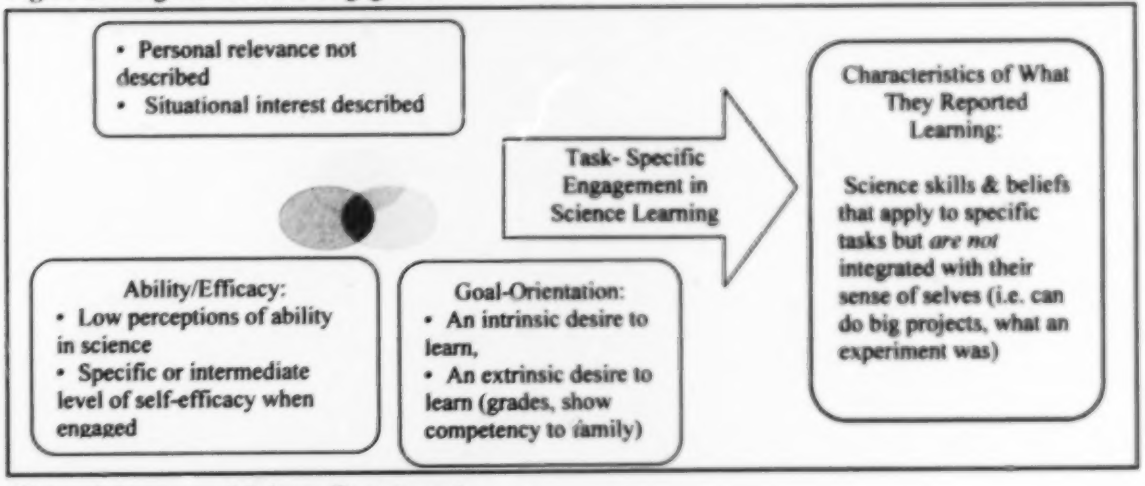
• Personal relevance not described
• Situational interest described
Task- Specific Engagement in Science Learning
Characteristics of What They Reported Learning:
Science skills & beliefs that apply to specific tasks but are not integrated with their sense of selves (i.e. can do big projects, what an experiment was)
Ability/Efficacy:
• Low perceptions of ability in science
• Specific or intermediate level of self-efficacy when engaged
Goal-Orientation:
• An intrinsic desire to learn,
• An extrinsic desire to learn (grades, show competency to family)

Figure 3. Impersonal Science Engagement.

In comparison to extracurricular contexts, in science the girls describe fewer ways in which they relate to the activity, lower levels of efficacy beliefs, and fewer mastery goal-orientations. *Impersonal Science Engagement* differs from *Integrated Science Engagement* in that the girls do not describe how their science engagement is personally relevant and they describe a focus on grades. These girls describe an alternative way of engaging in the absence of personal relevance but at the cost of failing to integrate science skills, beliefs, and values with their sense of self.

Fundamentally, these patterns speak to the importance of recognizing the influence of multiple factors on engagement across learning contexts. Understanding extracurricular engagement and modeling it in science teaching might promote sustained context engagement instead of sporadic task-specific engagement. For some girls, there are important similarities between science and extracurricular engagement, particularly in terms of personal relevance. However, the frequency of engagement differs dramatically. If fostering engagement for mastery and development of intrinsic motivation is the goal, then focus needs to be on understanding ways in which students find material personal relevant. Following is a discussion of specific ways in which these girls describe relevance when they engaged in learning science.

Sense of Self and Science Learning

This section focuses on part of the above model, namely personal relevance and the characteristics of what students learned in science. Overarching themes that emerged from the girls' words illustrate the significance of these pieces of the model to science learning. Across the three learning contexts examined, each girl talks about three themes central to her sense of self and engagement. They talk about *who they are*, *who they are becoming*, and *the importance of relationships*. In describing who they are, the girls describe core values and beliefs. When describing who they are becoming, they talk about skills they are working on for their future and their career aspirations. When describing the importance of relationships the girls describe their bonds to their families and friends and the importance of meeting new people. The strength of these values and beliefs are reflected in their words describing their engagement in science and other learning contexts. The themes they describe are consistent with adolescent development described in teenage girls (Gilligan, 1982; Hoyle et al., 1999).

Following is a description of ways in which the girls individually engage in tasks that personally relate to their beliefs about who they are, to their beliefs about their future goals and career interests, and to their relationships with family and friends. As described in the patterns above, all girls describe personal relevance in extracurricular contexts while only some girls describe ways in which they relate to science activities. I present data gleaned from the girls' voices as they described different engaging situations in science, extracurricular activities, and a favorite subject[3]. Science engagement is discussed first as it is the focus of this study. The girl's sense of engagement in science is described in general terms and then specifically with reference to the task or area they described as personally engaging. Their descriptions of engagement in other contexts are used for comparative purposes. Also described are the girls' interpretations of what they learned from being engaged in different contexts.

Beth

Beth sports a red shirt with a cut off collar and rolled up sleeves. Her hair is dyed three different colors and nose and ears are adorned with several rings. A black and white stuffed panda bear clings to her backpack. Beth enjoys activities that have an active component and she especially likes playing sports. Beth has a list of activities she enjoys:

> I watch TV, hang out with my friends; mainly it's hanging out with my friends - shopping. I like rearranging my room because I have a lot of stuff in it. Just like little things, like go make food, walk down to 7-11, walk my dogs, go to the park. Like if it's a

> nice day out, you won't catch me inside. I wouldn't want to be inside, I'm outside running around with my friends. And swimming, I love swimming.

Beth likes any type of sport and particularly enjoys physical education class, but she does not necessarily buy into school as a whole. "I could care less about education, just the way they try to make us do it is crap. I don't like the way they try to teach us." She has a 1.9 GPA and states part of the reason she is not doing well is because she spends time with her friends and family: "That's the main reason why I'm failing school is because of homework - I'm normally out doing stuff with my friends and family instead of doing homework." Beth chooses to spend time with friends and when she lists her values, friendships are at the top of her list, "I love my friends, my friends are my life. And I love meeting new people. I'll just walk down the street and say hi to people I don't know."

Science engagement. Her feelings of frustration with school are not always present, in fact, Beth has a generally positive outlook toward certain classes in school and teachers—particularly her two favorite classes, physical education and science. Beth did not pass science last semester and according to her current science teacher, she is barely passing this semester. Despite her negative attitude toward school Beth finds science class interesting and worth attending:

> I know half the stuff I learn in school right now I'm not going to need later in life. But some of it's pretty cool to learn about. But that's just because biology is cool, I like biology, I like science. I enjoy class, I actually try to go to class.

She claims science is "both confusing and interesting." It's confusing "because just all the different scientific names and the technical terms and the way like atoms and cells work and all that other stuff, just how they all tie together. It's just really odd." While these items are confusing she also describes a fascination with science: "I just have that strange fascination with life and how it works and why we die and where our energy comes from and all that stuff, why our heart beats."

Beth describes engaging in science fair projects for both 7th and 8th grades. Beth chose to investigate her favorite animal: "I've seen lots of stuff on giraffes. I've done reports on giraffes too. It's my favorite, the giraffe. That's the animal I know the most about." Beth describes posters she has made and ways she collecting information from a variety of sources. She believes her science fair projects stand apart from her normal projects in school because it was "just something I was into, something I liked. It's hard for me to get into something if I don't like it because I don't want to do it. Just certain science stuff that I can get into." She also describes being engaged in a recent lab that examined living organisms found in drinking water:

> Just looking at those and drawing those were so cool because you got to watch all this stuff swarm around and swim and see what's in the water. It was just strange because okay, like there's this weird little thing, looked like a bug, except for when its mouth opened, it had these things on it that looked like chainsaws and it was sucking in the water. Makes me want to not drink water now . . . but it's still cool.

This lab appealed to Beth because she had "never actually seen something in real life like that." The lab led Beth to wonder "why are these things there, their purpose that they're in our water. What's the point of us having little microscopic things all over?"

In physical education and sports in general, Beth describes being engaged more globally, as opposed to specific science tasks. She says she is "into all sports." She describes being involved in skateboarding, hackeysacking, basketball, and volleyball. For example, she describes being engaged in playing volleyball games "where I'm in tune to it, everybody's talking to me, I'm not listening to them and my mouth's open and I'm like come on, now. It makes you want to scream like ooh yah."

Personal relevance to science learning. In science Beth says she is interested in learning but only to a point. Whether or not she is engaged in learning depends on her personal interest and classroom activities:

> It depends on what we're doing that day or how I feel. By the time I get to 5th period I'm drained of everything. I just want to go home, it's sunny outside, so my mind has a tendency to trail off no matter what I do in science. But if we're doing something I can actually get into I'll try my hardest. Because right now we're doing something on flowers, I'm not really into flowers! Flowers isn't my favoritest thing in the world. I have to do it anyways.

Beth's effort is dependent on her interest and the type of classroom activity and her interest does not extend to flowers. In fact, Beth's science teacher notices that during the flower project Beth spends most of her time hovering over a different group's project on an animal dissection. Beth puts more effort into studying "animal stuff" because she views this type of material as relating to her dream of becoming a zoologist.

> I'd have to say like the animal stuff, I remember the animal stuff the most, because I want to be a zoologist so all the animal stuff intrigues me more. It makes me want to know more about it, so it sticks better. I want to work with animals. That would be the coolest thing in the world. I want to like live in Africa and have giraffes in my backyard and have like lions going through my house and all this other stuff and just taking care of baby lions and tigers and stuff, because cats and dogs, I see those every day. Screw that, I want to go out to really exotic animals and all the cool ones.

While the pursuit of this career interest may have some unforeseen barriers, Beth views studying animals as important and is hoping to enroll in a zoology course next year. Beth also reports watching a few hours of animal programs daily. Additionally, Beth attributes her ability to remember content relating to animals because of her career interest.

In contrast, to the zoology science fair projects, her engagement in the lab examining organisms in the drinking water has little relevance to her career interests and does not deserve as much of her time outside of class. When I ask how if the experiment was important to her she states, "I think it's pretty cool when I can look at a bug and like oh, I learned about that bug today or I know what's in you or something, but that's about it. I wouldn't go out of my way to study it. But if it was in class and we're studying about it some more, that would be cool."

Sports have a different type of importance, they are important for relating to others and staying healthy. She states that she loves sports because "I love anything that has to do with social and meeting new people. Because life's boring if you're stuck with the same people - the same people are cool but you gotta meet new people." Beth also believes sports are meaningful now and for her future because "it keeps me healthy, keeps me from sitting on my butt and just eating, because I like to eat too. So without any sports or nothing I'd probably not be able to get up because I'd be all big. So it keeps me healthy." In sports Beth reports learning a combination of skills and something personal:

> You learn physical work like certain ways you can fall on the ground and hit the ball over without hurting yourself. Because I learned that after a while because I was hurting my knees, so I learned to slide instead of diving, just like slide down and get it over. Just slide, just run and slide. You just learn new ways to hit the ball and new ways to hit to people that have not hit the ball on the other team.

She also believes that playing sports has taught her interpersonal skills: "I learned teamwork pretty much. It teaches me to be with other people. You pretty much need the team, I learned that you need your team or you're nothing."

Similarly, Beth believes she has learned about animals and herself from her project. She has learned specific content about giraffes as well as animals in general. She shares some of what she learned about giraffes: "They're tall and lanky and have long necks and blue tongues. They got five horns. They're just odd animals." Beth also believes that engaging in zoology projects has taught her to appreciate animals' "smartness":

> I learned that animals are not things to be taken for granted because I hate it when people call animals dumb, because you know there are some dumb animals, but they're all smart in their own way. And that's how I feel about all animals is that they all have their own smartness in what they do because they're born with certain stuff, like they're born with their instincts - we don't know how to walk when we're born, we don't know how to talk. Our moms got to change our diapers. When animals are born, they know how to walk, they know how to hunt, they know how to get their food so they're all smart in their own way.

Additionally, Beth believes that having an understanding about animals helps her learn content in class: "When she talks about animals I understand about the animals because I've already studied a lot about animals and all that stuff, but like the cells and stuff, I still don't understand." Beth believes having a prior knowledge helps her understand what she is learning.

When engaged, Beth feels good about learning and is more committed to her career goal: "It made me feel good because I knew more about giraffes than I ever did before. And it made me want to be a zoologist like ten times more, just so I could take care of giraffes." Beth also adds that she learned that she could "actually have fun doing schoolwork, and that doesn't happen very often."

Mica

Mica is tall, thin and wears a stud in her eyebrow. She lists several of her hobbies: "I hang out with my friends, listen to music. Watch movies. Swimming. Shopping. I like writing a lot too. I like to write journals and stuff." Mica spends time writing at home and believes her favorite class is "Language Arts. I like free writing, that kind of thing." Another hobby Mica has is taking acting classes outside of school: "I just started an acting class downtown and so I'm learning like public speaking skills and that's fun. I go there Saturday for 2 hours and it doesn't feel like 2 hours at all. I meet all sorts of people there."

Mica lists family, friends and faith as her top three values. She values having "people to talk to." Talking to others is important to Mica and she says working on being better at talking to others: "I'm pretty shy actually, so I think I've gotten better at talking in past years. I used to be pretty quiet. I'm still quiet, but not as quiet as I used to be." She believes being able to talk and listen well are skills that are important to being "a good friend" and becoming a "youth counselor."

Mica believes school is important "just for where I'm going and what I'm going to do with life. Because I want to be a middle school youth counselor. I like talking with people and giving - helping people's problems, a lot of my friends come for advice. I think it would be interesting." She currently has a 2.5 GPA and believes part of the reason she is not doing well is the transition to high school:

> It just seems like high school has been hard. It's just a lot of like the changes and different new friends. You have to start all over, it's a lot different, there's a lot of other things going on. It's hard to keep up, stay as focused - other things like family and friend problems. Things that make it hard to just stay concentrated all the time on school.

Science engagement. Mica struggles in science and is taking a class that repeats the content covered in the first semester. "It was pretty much when I started biology when I just - it just became so confusing to me that it stopped me." Her current science teacher notes that she frequently skips class but that she does enough work to maintain a C in the class. The teacher also reports that Mica often socializes in class and does not pay attention during activities such as group work.

Despite an apparent apathy toward science, Mica holds a core belief that science is important and related to her life. Her particular interest is in the environment. She sees herself as linked to the environment and believes that people need to take care of the earth: "As far as like animals and plants and stuff, we wouldn't be without them, we need them to survive, and then as far as like just the earth and things, it's where we live, it's our environment. We need to know about it to be able to survive on it."

Mica's example of engaging in science is consistent with her view of science and science learning. She talks about an environmental project she participated in a previous year.

> We did a group project on how much garbage we produce, like in the U.S. That was pretty interesting. And like what we do with it, how we get rid of it, where it goes and stuff. My job was to get the facts, like the recorder, and look through and wrote down the research we got. I had to look for the stuff about it. We made a poster with pictures of animals and things being affected by it. Even though we worked on it for a week, it didn't get boring, I still wanted to go there [class]. I was interested. I guess focused too.

Mica characterizes her engagement in this project as being interested and not getting bored as well as being focused. In our interview, Mica struggles to remember projects from science and jokingly refers to knowing that she was involved in this project, "I guess because I remember it."

Her one example of being engaged in science stands in contrast to the multiple times she describes being engaged in other learning contexts. In her language arts class she is engaged "probably when we're doing descriptive writing. It just comes; you're thinking it but putting it down as fast as you're thinking." She describes being engaged in descriptive writing not just in one particular assignment. Mica describes a similar type of engagement in descriptive writing and acting class: "I'm interested, focused. Pretty much excited, same kind of feeling as when I'm doing acting." She describes being engaged in acting class and preparing speeches for class.

Personal relevance to science learning. For Mica, finding meaning in her work is important: "You work harder when you know there's going to be benefits from it and when it's fun and interesting to you. Like how it's going to help you later, what you're going to take from a class, what it will do for you in your future." She determines how much work she should put into a class by considering how the class applies to her future. She takes this thought one step further by stressing how relevance is important in determining which classes are important:

> I know they're all [classes] important because that's what people tell you but to me, Language Arts is important. I think it'll help me with being able to talk to people and writing. Talking and counseling, it might help somewhere in there.

Finding a class meaningful is also important in classes she is not passing. "I'm trying to get help on math this summer, I'm going to get help with a tutoring type thing because I know it's important and I'll need to know it. I'd like to understand it. It'd be nice." She values learning math even though she is not sure how it is important to ***her*** future: "I know it's going to be important to know - I'm not sure exactly if I'm going to need it in my career later but it would be nice when I have kids to be able to explain it."

Mica believes that science is a subject that "relates to my life in every way, pretty much" and believes science tells her about herself: "It tells me about our world, about my life, about how we came about, what we consist of. Our DNA and all that kind of stuff." Mica believes science is as important to her as it is to everyone else; "I think it's as important for me as it is for everyone and that we should know

things about our earth because we need to keep it." For Mica, science relates to her life because she views science as a "part of my life."

In many ways, her garbage pollution project is similar to her core value that the environment is important. She simply states the reason she found her project relevant: "Because of the environment." Mica explains why she thinks caring for the environment is important:

> Whether or not - I mean if we're not careful, depending on how we treat our earth now, whether or not we'll have it later, whether it'll still be the way it is now. Because the earth is the only one we have. It's important to learn about just how important it is to us. Those things are important in general, and to me.

Acting class and Language Arts are important for different reasons- both are important for working toward her personal goal of improving her communication skills. She believes that descriptive writing is also personally relevant; it allows her to think about what she is writing and "how it relates to my life, things that have happened or situations." She also views it as an opportunity to express her emotions and reflect "on what you learn from a certain experiences."

Mica believes what she learns in acting class and through writing applies generally to her life in that she learns skills for communicating with others and for improving her descriptive writing. Learning how to write also helps her build communication skills: "I just think it's [writing] nice for me to know - yeah, being able to describe things also makes it easier for you to talk - it'll help me with talking and counseling, something like that!" Mica's perception of what she learned when engaged relates to her goals for becoming a better communicator and youth counselor.

Similarly, Mica believes she learned content related to her garbage pollution project as well as something about her sense of stewardship.

> Just learning how, I mean how much garbage we produce and how it makes such a difference about what kind of materials we use and how it affects our earth and what it's doing to our earth. It made me think about how we treat the earth, how we could be better, you know like - it provides us with so much, how we're harming it. We can be really wasteful; we should pay more attention to being resourceful.

She describes how this understanding has affected her daily actions: "I think about it now. It made me think twice about whether you choose to recycle or not and whether you need to use paper plates, or you could reuse water bottles, that type of thing, instead of buying just another water bottle."

Thalia

Thalia wears sweatpants with a large soccer ball emblem. She has short blond hair and bright blue eyes. Thalia plays soccer for three teams and lists her other hobbies as: "Shopping. Music, I like to listen to music. Hang out with friends. Hang out with my mom. Go running." Thalia describes going for long runs and "thinking about everything I need to get done for school and what's going on with my family. Just thinking about what I'm going to do this weekend, who's going to be here and who's not." Thalia believes her family and friends are the most important part of her life because "they're always there for you."

Thalia spends time thinking about her social life and believes her social life is important: "Now that I'm in high school, school's like half important and then my social life is half important." She states that she spends time at soccer thinking "about my social life and other things, but usually I try to stay focused and watch." While Thalia believes school is important for "getting ready for a job and for a future life" she says the reason her GPA has dropped to a 2.3 is because of teachers and because she has trouble focusing in school: "When you have so much stuff to remember and then you have your parents

and then you have friends and everything else, it's hard to focus on something you don't really enjoy or want to do it."

Science engagement. She states that in science she has a difficult time paying attention for similar reasons: "I'm not usually even looking at the teacher, I'm looking at something else and thinking about friends. Or instead of taking notes we'll just sit there and talk the whole period and then copy them later off somebody or something. Instead of really paying attention." Thalia says that she frequently gets in trouble for talking with her friends, "I'll be talking but I'm not the only one talking in the whole class, usually I get - because I'm a lot louder so usually they look at me and I'll yell back, I'm not the only one. Because when it's boring, I want to talk to my friends about other stuff." Thalia, failed first semester biology and her teacher reports that she fluctuates between a D and an F in her current science class. Her teacher also reports that Thalia rarely completes her work and that "she will only do her work if *she* is interested."

Despite her quarrels with the teacher and her apparent negative attitude toward school, Thalia describes science as both "confusing and amazing." It is confusing because "the little details you always have to remember, like the names - just different things. Like big words. It just takes a while to learn, after a while it gets old so you just kind of quit." Other topics such as "how your body works, medical stuff, and diseases, just those things" are more interesting because she is interested in "how everything works together. Just everything flows, like if one thing gets out of place, then it ruins everything else, like a chain reaction."

Thalia's interest in the human body is reflected in the time she engaged in a Down's syndrome project. She describes her project:

> We had to figure out all the chromosomes and figure out what kind of disease we had and we had Down's syndrome and we had to tell the class about it. We just had to research it and then we gave a presentation about why it happened because you get a certain chromosome more than you should or you lost one you should have had. It was easy but at the same time it was kind of challenging if you didn't have any information.

Thalia was invested in researching Down's syndrome; she found information on the Internet and interviewed her mom, a nurse. She states that she "was focused on it instead of just fooling around and not really taking time to do it. I wanted to make sure I got everything done." Thalia believes she only feels this way "every once in a while. Not a lot. Things aren't really appealing in science."

Thalia is terse and slightly bitter when talking about school but lights up when she talks about this project, as well as playing soccer, reading a book for Language Arts (which she has subsequently read seven or eight times), and writing a paper about a dream she had of her late grandmother. Thalia describes being "focused and interested" during these events, and characterizes herself in a "flow state where I'm not paying attention to stuff that's around me. Just everything around me, like I focus on what I have to do."

Personal relevance to science learning. In science Thalia feels like she is motivated "just if it relates to me. And the teacher's doing it so it sounds fun and sounds kind of cool, I can get into it." She thinks science is important in general but not specifically to her right now.

> Science helps people just learn about everything. And why stuff happens in life. Like pollution. I mean it is important but I don't really think about it. I probably will when I get older but right now I just don't care.

Thalia is very clear about the importance of finding relevance in her work; the material she likes to learn

> It usually it has to relate to my life, like moths and plants are not that great, but my body's interesting. I have a body, that stuff happens in me, and you don't really notice it because you can't see it.

Thus Thalia does not believe science is important *to her* unless the material is about the human body. In this way she is concrete; studying the body is significant because she has one. However, Thalia also believes that studying health is necessary to her.

> I need to know about health for everyday life. If people didn't know about drugs and alcohol and everybody just did it and didn't know the effect of how it hurt you. It's important because you need to know how to take care of your body. I don't want to die young of health reasons that I can stop. It's more important to keep yourself healthy than to be smart.

When I ask Thalia why she thought she did so well on her Down's syndrome project she brusquely states, "Because it related to my life." Thalia views her project as relevant to her future. She believes studying health-related material relates to her interest in becoming a teen psychologist:

> It's [Down's syndrome project] important because I think I'm going to do something in the medical field, something that has to do with people when I get older. I wanted to be a neurosurgeon but that's so much school and it costs a lot of money. So I want to be a teen psychologist.

She holds strong beliefs about why this "medical career" is important:

> Just listening to all my friends' problems and the problems I've had, it would just be good to have somebody to talk to who doesn't go tell everybody else. And really knows that person and you feel like they don't judge you because they don't really say anything back but good advice.

In addition to finding relevance with her career, her project is interesting because views the activity as a way of learning more about her cousin:

> Because I have a cousin who has it and it got me to understand more about what goes on through his head and how he got it and everything like that. Because I have a family member who has it I like really wanted to learn the facts, like it was interesting to see why it happened and what you should do about it.

Similar to her beliefs in science, Thalia views soccer as important to her life is because she values keeping herself healthy. She talks about the relative importance of soccer now and in her future: "It's not the most important thing but I'm glad it is in my life. Because it gives me something to do, to pass the time. It keeps me in shape. I don't want to play soccer when I get older. I'll probably just exercise." In soccer she describes engaging in activities that relate to family. Soccer is an activity important to her family: "Everybody in my family has always played soccer, like my grandpa used to play professionally for Greece; all my cousins did it, my dad still plays, my uncle, my aunt. So my whole family played so I just thought I'd play." In soccer Thalia learns "basic skills" but she also believes she learns skills that are applicable to other areas of her life. She believes she has learned "how to hold back my anger. Teamwork. Leadership." She also believes she learns "communication. I know how to work with people and deal with people."

In school, both in Language Arts and in science, Thalia believes the few times she did engage; she also learned something about her important to her life. She believes reading her book and writing

about her grandmother allowed her to reflect and learn more about herself and her personal relationships. When reading she feels that she learns something "new about myself each time" she reads the book. When writing her paper about her grandmother she had an opportunity to "think about things that we did together, and different things she would tell me."

In science she describes how engaging in the Down's syndrome project increased her knowledge of the syndrome, heightened her interest in a medical career, and helped her build confidence for doing a similar project in the future. She broadly describes the content she learned but emphasizes its novelty:

> I learned so much stuff that I didn't know before. It was all new. I was happy because I learned something I didn't know about. I learned like how long they live and what they go through and how they can take classes to live on their own and some people have it worse than others. And how to deal with a child who has it.

She also believes that engaging in this project taught her that she is "really into medical stuff and I'm really into helping people who have disabilities." She states that this interest was not new but that being involved in the project "made me more interested" in having a medical career. Thalia also believes that even if she does not remember the content from the project she feels like she can more easily research medical issues: "Because what if I have a kid that has Down's syndrome, I'll know about it if I remember it. I'll know how to research it if I don't remember anything." Thus she learns a research skill that might be important to her role as a mom.

Crystal

Crystal has long blondish hair and wears bright blue eye shadow. Crystal lists her hobbies as "Shopping. Going to movies. Hanging out with my friends. I'm rarely home. I do a lot of stuff with my youth group too. And photography." Crystal has taken 3 semesters of photography and also learns from her step-dad: "We went to Mt. St. Helens and he helped me with the light and getting the angle of the mountain in the middle of the picture." Crystal was considering becoming a professional photographer but decided she likes it better as a hobby. She takes pictures at youth group dances as well as pictures for her website. Instead of photography, Crystal now aspires to work with children: "I want to be a preschool teacher. Or kindergarten, one of those. Something I don't have to take too much college for! Because I work with a lot of kids, I go to a church and they ask me to baby-sit a lot. I think it's a lot of fun."

She says the reason she attends school is "so I can get a good job and I can show my family and myself that I can do a good job" but believes "I'd rather do something else than be at school." Graduating, and specifically having enough credits to graduate is important to Crystal.

> My grades are bad so I have to have good grades to graduate, so I just like keep telling myself over and over again, that I have to do the homework. I found out I could actually pass if I do a couple more assignments. I want to show my mom that I'm smart, that I can do it.

Her sister did not graduate and Crystal believes that she needs to "at least get through with what I need to do. Because a lot of families, their kids don't graduate." Yet she has little interest in her classes: "I have to do them to graduate. None of them are really interesting to me. Basically I'm just doing it because I have to. Some of the things we do are fun, but most of the time it's not really."

Science engagement. Crystal holds similar beliefs for science and repeatedly states that she does not like science. Her science teacher reports that she consistently averages D work this semester and that she infrequently engages in science labs. Crystal believes science is difficult and that it requires patience and a willingness to learn.

> It's hard. You have to be patient because right now we're growing plants and we have to be patient on how fast they grow and stuff. You have to be willing to learn to just sit there and watch something grow because some of the people in my class are watching tadpoles grow and how fast they develop. So you have to be very patient with that.

When I ask if she has these characteristics she replies, "I don't have the patience." Her proclaimed lack of patience is evident in her discussion of "big projects." The degree to which she likes doing projects "depends on how big they are. If they're small projects that don't take like a long time, then I like them, but if they take a long time and a lot of thinking, then I don't like them."

Moreover, Crystal states that some topics in science are more interesting than others: "I like animal stuff, learning about animals. I like learning about animals and how they grow. The differences between different species. But plants are just boring! And fungus, you know!" She qualifies her interest by stating, "But a lot of that stuff I'm not really interested in."

Crystal describes a time when she was engaged in learning science, "back in the 7th grade." She describes being engaged in a science fair project where she investigated bread mold:

> We had a science fair and I did it on bread mold and I was focused on that, how to grow it, I took down where I put the bread and what happened to it in the different environments I put it in. I was pretty focused because I had to pay attention to it every day. I had to make sure I was doing it right and I didn't miss anything because I had to explain everything. Like what was happening. I spent a lot of time figuring out what changed day to day. I had to be pretty patient, it took a long time for it to start. On one I put bread and another one I put water on it and another one I put a little tiny bit of water. I had to pay attention to which one was which and stuff.

Crystal describes herself as being the opposite of what she believes science is typically like for her; she is focused, patient, and attentive. Further when I ask if she was excited about the project she replies, "I don't really like science so it was just hard, I guess, because I didn't want to do it, but once I did it, it was better." Crystal says that she frequently does not feel this way in science: "Well, I usually get frustrated a lot. Sometimes I just give up." She starts to describe another time where she thought she was engaged: "We had to draw a bunch of pictures of different mushrooms so that took a long time." But quickly Crystal states that this project was "not interesting to me. So I didn't really want to do it. I basically don't like science that much."

Crystal also describes herself as "focused" when engaged in other learning contexts. She discusses writing a paper about a personal relationship for language arts: "We had to write a persuasive essay on our lives and she gave us different things, a time when your heart was broken or something. Once I got going I was pretty focused. I hated to be interrupted." She differentiates her engagement in this paper by describing that she usually gets "sidetracked a lot. It's hard for me just to sit down and write for a long period of time." Similarly she talks about how well she concentrates when taking pictures: "I concentrate really well because I have to concentrate on the light meter to make sure it's on the right setting so that it'll turn out the best it can."

Personal relevance to science learning. Crystal views science as important in general but not to herself specifically:

> We all need to know what everything is and where it came from, I guess. Yeah, I think it's pretty important because a lot of people believe in a lot of stuff and we should all know where all the animals and different things come from. That's pretty important, the different things around the world, where the grass comes from.

But Crystal does not believe science is specifically important to her; "Not really, I don't really care." She states that science might be important in her future:

J: Do you think science will ever be important in your life?
C: Maybe when I get older. But not really right now.
J: What ways would it be important when you got older?
C: (laughs) I don't know.
J: But do you feel like it has any impact on your life right now as it is?
C: Not really. I just don't really see anything interesting about it.

While science might be important in the future, Crystal is not familiar with ways science could be relevant now or in the future. Her response prompts me to ask if science might be important for health reasons, a reason other girls in this study cite as rational for their interest in science. Crystal responds:

C: Yeah, because you need to know - we studied mushrooms and poisonous mushrooms. They need to know what it is and if they eat it they can die. That's pretty important for health reasons.
J: Is that important to you?
C: Not really because I don't really eat anything like that.

Thus Crystal cites an unlikely event, as a reason for believing science can be important for health reasons. Crystal explains that the reason science does not relate to her is because it goes against her religious beliefs:

> I mean when they teach evolution, I don't believe in it, so it's kind of hard for me to sit there and listen to it. I just don't believe in it so I don't see any point in learning about it. But yet a lot of people do believe it.

Crystal also describes having little personal connection to her bread mold project; nonetheless, she believes she was interested in the project. "Because it was interesting. Growing bread mold, who does that? Like 1 in a million people. Because a lot of people were doing things like ice and hot ice [sic] or whatever that stuff is called. People were doing things with gerbils. It was gross, too."

Crystal describes what she learned from her bread mold project: "That I can actually do something like that, big projects, because I didn't think I was going to do it very well, but I actually got a pretty good grade on it." Crystal specifies that she learned she could do something "project wise," not necessarily "science wise." In addition to boosting efficacy beliefs for completing projects, Crystal believes that she learned "patience," a skill she can use later in life: "It helps me to be more patient knowing that I have to get it done. I just have to take the time. It's important because it'll help me do better on different projects that I have to do and different experiments." When I ask if she would engage in a similar project again, Crystal replies, "If I had to. For school, if it was a required thing to do. Probably not. I don't have that much time on my hands."

In other contexts, Crystal describes participating in activities that relate to her life. When engaged in writing papers for Language Arts, Crystal describes being more interested in papers that are about herself: "Because it is about ourselves so it was easy to write about, like it happened to us." Crystal compares writing essays about herself with other assigned essays:

> If they gave us an essay - in history class we do a lot of essays on different wars and stuff and it's kind of hard for me to write about it, because you don't really know what happened. I mean I read about it but I'm not really good at writing essays. It was more interesting to me because I went through it. It was my own life. But I just put anything down for like the other essays; I had to think about that other one.

Thus not only is writing about herself and her experiences more interesting, but Crystal believes she is more competent at writing these essays. From writing an essay about a relationship, Crystal reports learning the value of taking time to write personal essays: "It's better for me to like - if I go through something, it's better for me to take time and write about it. I learned I took more time and effort to do it. It's easier if I have the experience again." Crystal describes writing and thinking about personal experiences as an opportunity for self-reflection and self-improvement.

In comparison to her bread mold project and her personal essay, Crystal describes a wealth of skills she learned in photography:

> I learned there's different depths of field, you can go close up or far away and angles and which one turns out better, what light you can use. If it's too dark you've got to use the flash, you have to have a certain speed of film or it won't turn out as good as it should. Like the higher the speed, the more clear it is, and then the lower, it's more grainy, you can see the grain.

She also believes that engaging in these types of activities has helped her become more competent and confident in photography: "It helps me know that I can do it if I put my mind to it. It helps me realize that I can do it, even if it turns out bad I can do it over again and it'll be okay." She describes a sense of competence for future engagement.

Rosa

Rosa wears her brown hair pulled back neatly and has two studs in her eyebrow. She wears a tank top she made in sewing class. Rosa identifies herself as "non-white" and has strong connections to her Venezuelan heritage. Rosa describes lists some of the things she likes to do when she is not in school and also references previous engagement in sports:

> I usually just like to hang out with my friends. We don't have like certain activities. I like going to social events like parties. I also just like to rest, just lying down, watching TV. I like to shop. I work too. I work at a bakery. I used to do sports, then I got really lazy. I used to do crew but then - it just took my time away and my grades kind of slipped doing sports so I kind of quit that.

Rosa has had trouble doing well in school but has recently, as of this semester, undergone a change in attitude. She states her poor grades were a "wake-up call" and now "grades are everything."

> Last year I used to skip a lot, like I would just skip class and go home. But now I don't skip hardly. I didn't get credit in a couple classes last year because of that so now I'm trying hard. I go through these phases, I'll get my grade slipping, then I'll start getting into everything. It kind of gives me a boost. But if I have like an A, then I just do the work.

Grades are also important for impressing her mom: "My mom, she didn't do really good in school so she struggled. So I want to impress her, tell her I can do good." Rosa believes that her parents are proud of her earning higher grades: "I don't know what motivates me - my parents were really happy when they got my report card, that made me happy too. For once I didn't have to like hide it."

Science engagement. Her science teacher emphasizes her dramatic change in grade from an F to a B in science and states that she only occasionally skips class now. Rosa claims she participates in

science for the grade and because it is a graduation requirement "if I don't pass this class, then I can't go to Biology 2. So it's kind of a requirement. So I'm trying a little harder."

While she feels compelled to attend class and earn good grades, Rosa states has "lost interested in science."

> I'm not too interested into science right now, personally. I don't hate it but I don't have a passion for it. Some things are interesting about science – I can't think of them right now. Mostly I just don't really like it.

She describes science as "not very interesting" and "confusing." Part of the reason Rosa finds science not interesting is because "is just a repeat, it's old. I already kind of learned everything in Biology 1 and in science we're doing the same stuff. So I'm not really interested. I just haven't really been like learning." This differs from her interest when she was younger: "Like in middle school I was learning new little stuff [in science] that really was new to me and interesting." She finds her current science class "a lot more confusing [as compared to middle school]. Probably because we have to memorize a lot more things, memorization and all the photosynthesis and all that stuff is so confusing."

While Rosa is not interested in science, she describes three times she felt like she was engaged in science. In the first example Rosa describes being "jumpy and excited" during a 6th grade chemistry experiment. She also identified this example as a time where she saw herself as having "scientist-like" characteristics:

> When I was in 6th grade we did this one experiment and I got really interested in it and she [the teacher] was like put this much into this to see what happens, and I put extra to see what happened because I was curious and she thought I would be a good scientist. We mixed like baking soda with something; it was some experiment about chemical reactions. It bubbled up and it really interested me, I got really interested and I kept asking the teacher all these questions.

Rosa describes herself as "interested" and "curious." She states the lab "was something interesting that you've never seen before, something new - something you can see and touch."

While Rosa believes she no longer feels the same way in science, she provides two examples of being somewhat engaged in what she was learning in her current science class:

> I TA for a biology teacher and when I get interested, I'll listen. She does experiments that are fun and interesting. She'll get pond water and put it under a microscope and hooks it up to the TV so you'll see little bugs floating around. She did this thing where she put this marshmallow and took all the air out, just different experiments that were like interesting to look at, kind of caught your eye.

Rosa describes being interested when something catches her eye. Similarly, Rosa describes an experiment in her current science class that she started to engage in: "Oh, there's this fun one we did, where we looked at a piece of lettuce under a microscope and looked at the stoma - that was interesting because we looked at it under a microscope. I kind of got interested in that for a second." Thus while Rosa describes herself as no longer being interested in science she provides two examples where she describes herself as being "interested" if only briefly.

In crew and during a language arts project Rosa also describes being "interested" and "into it." She describes being engaged in crew and investing extra time to read packets and watch videos to improve and she would "actually do that before I did homework, I was so into it." She also describes working hard on an autobiography poster and essay in language arts I did this life map where you have this big poster with the most important events of your life - you could put pictures or illustrate it and then

you had to write a little essay about yourself. I cared about it a lot. I'd stay up til like 1 in the morning to finish it. And I really tried hard on that. I always like doing little things about myself."

Personal relevance to science learning. Rosa believes science is important in general but not necessarily to herself or her career. Rosa is adamant that science is important; she provides a list of reasons why: "Oh yeah, it is. Because that's how people find out things, like about the world. It explains a lot of stuff. How things came to be and why things are the way they are. Like why plants grow and why the weather changes and why the sun goes down and comes up. Just things that we should know." She views science as important but not important to herself or her future goals: "I'm not really interested in it but I know it's an important factor." She holds two reasons for not believing it is relevant to her life. First she believes that people can get by without knowing science, "we can just live knowing the basics, you don't have to know everything." Second, she states she does not know how science could relate to her career interests; "I don't know how I'm going to use it later. I don't think I'm going to do anything that has to do with science in my later career."

Rosa distinguishes a science career from a medical career. She states that she does not want a science career, but that she would like to be a nurse or mortician. She is not certain what this entails but sees medical related content as pertinent:

> I kind of want to be like a nurse or something. Something that has to do with medical. With people. I'm always interested in like - my mom's a nurse and she always tells me about different diseases and stuff. I've always thought about being one of those people that work on dead bodies, forensic pathologist or something, and I thought you have to go to medical school for that. So that'd be fun.

For this reason she believes medical related material is relevant and worth of study: "Well, if I want to go into a career with that, I'd have to study more, so yeah. I wouldn't mind studying that." She cites this as being the reason she thinks health class is more interesting than science class: "I just have more interest in health than science. That's probably why I tried harder in health. I listened more. I liked health. I was really good at remembering all the bones and the system, the circulatory and respiratory." She attributes her differential effort to the relative usefulness of health as compared to science class.

Her reason for not viewing science as relevant mirrors reasons she did not find her the labs as relevant to her life. She believes her science labs, such as the stoma lab, are not important to her life "because I don't think I'm really going to use the information I'm learning right now. It's nice to know how photosynthesis works and plants and cells, but if I'm not really interested in a science career, it won't really be good to me." In addition to not relating these engaging experiences to herself, she has little to say about what she learned from these experiences. Rosa simply states: "I kind of learned what experiment was. When you try something and see what happens and you did little hypothesis things."

In contrast Rosa believes she learned a lot about herself through her papers in language arts as well as in crew. Rosa talks about learning "directly about myself" in her life map project. She states that these types of projects are "fun because it's always fun to talk about yourself. That's something I like to do." Moreover, when doing projects where she learns about herself, she is less likely to care about her grade. "We had to do this big culture project and that was a really big deal. And I tried really hard on that and I didn't get a good grade on it, which really made me mad. Actually I had fun doing the project." Despite getting a bad grade she continues to view the project as worthwhile because it relates to herself and her heritage; she believes the project was still important "because I'm Venezuelan so I want to learn about Venezuela." From her autobiography project, Rosa also believes she learned something about herself: "I kind of just took things from like the past and I kind of realized about my life and things I've been through." Rosa also believes she learned that "doing projects can be fun."

Crew has a different type of importance for Rosa. Rosa states the way crew relates to her life was that "it was my life." She describes learning mastery skills and learning valuable life lessons. She believes she learned how to be responsible and says this has helped her be responsible in her job and her

newfound appreciation for grades. Rosa believes that crew was important to her life for building friendships and keeping herself out of trouble. Rosa believes friendships are important to her life and that crew "was kind of like a family." Rosa believes crew was also important to her life because "it kind of got my mind away from other things. My friends, they'd get into drinking, drugs and stuff, but I was too involved into sports to do that. It kept me out of trouble." She states that being healthy is important "because I don't want to get hurt or endanger myself. I just want to stay alive."

Discussion

The relationship between these girls and science engagement is tenuous, contingent on many personal and environmental factors. The girls recall only a few episodes of being engaged in science class; three girls recall only a single time. The girls discuss *who they are*, *who they are becoming*, and the *importance of relationships*. They talk about how these elements are central to their decisions to engage in learning—both in science and other contexts.

Some girls describe a time when they sought to master science content as a means for enhancing what they know about themselves. Other girls also describe the importance of feeling like their identity was intertwined with their learning but did not describe such situations in science. In these cases, the girls described a situational interest that did not result in learning content that was integrated with their identities. This study provides a starting place for understanding how to engage at-risk girls in science. It highlights the situational nature of these experiences within a larger framework of identity development.

Personal Relevance to Science Learning

The girls discuss the importance of engaging in activities that relate to some part of their lives. In extracurricular activities and in their favorite subject, personal relevance appears to be important to engagement for all girls. In science three of the five girls describe personal relevance to their engaging science task. Understanding the salience of their identities within their engagement is useful in documenting the multiple ways that the girls relate to what they are learning and describing potential entry points for learning science. Across learning contexts, the types of personal relevance the girls describe can be summarized into three types: (1) relevant to beliefs or values, (2) relevant to future goals or careers, or (3) relevant to relationships with family or friends.

The girls describe the relationship of science to their lives in a variety of ways. All girls describe ways in which science is important in general but they differ in how they view science as important to their lives, personally. Some girls see a direct link between themselves and science; others see no link at all. Beth believes science is important and interesting but only applicable to herself if the content relates to animals and thus her career interest as a zoologist. Mica believes that science is important to herself for the same reasons it is important to humanity. She believes that science relates to her because she is a part of science, and a part of the earth. Both Thalia and Rosa believe that health is important and relevant but view health as distinctly different from science. Thalia however, holds a belief that material relating to the human body and medicine is relevant to her body and to her career as a teen psychologist. Crystal and Rosa believe science is important but they do not think that science applies to their lives personally. Crystal states that science could be important to her life but cites an unlikely event as her rationale; she describes needing to know if mushrooms are poisonous but points out that this is not important to her because she does not eat mushrooms. Crystal also states strong religious beliefs as part of her reason for not seeing science relevant. Rosa describes a lack of usefulness of science to her career and future goals.

Their beliefs about the relevance of science are useful for understanding ways in which they choose to engage in learning science. Beth, Mica and Thalia's view of science as important personally is mirrored in their descriptions of being engaged in science. Their science engagement relates to their lives in terms of the three types of relevance described above. For Beth and Thalia, engagement in zoology and the Down's syndrome project, respectively, are connected to their *career interests* and *future goals*. Beth believes she engages in her giraffe project and anything relating to animals because she plans to be a

zoologist. Thalia believes that learning about medically-related material is pertinent to her career as a teen psychologist or that it might relate to her role as a mom if her children have a disorder. Thalia also views her project as relevant to her *family* because her cousin has Down's syndrome. For Mica, engagement in her garbage pollution project does not relate to a career interest but rather it relates to her personal *belief* that caring for the environment is important and that she is a part of the environment.

Not only do they describe how their engagement in science tasks relates to their lives but also Beth and Mica describe how their engagement is limited by the degree to which they find personal relevance. Beth states that she is more likely to learn when the material in science relates to animals and thus her career interests. Although Mica does not describe a career goal in science she believes that her engagement is limited by whether or not the material relates to her future.

Both career goals and future goals are important to meaningful learning (Covington & Wiedenhaupt, 1997; McEvoy & Covington, 2001; Shernoff et al., 2001). Studies have found that students show increased engagement in a subject that corresponds with present and future goals, and that students were more likely to *remain engaged* if they found the material relevant to their career goals. These findings have similarities to this study's findings in that they describe a portion of the ways in which girls found personal relevance when engaged.

Two of the five girls, Crystal and Rosa, do not see a link between their engagement in a science task and their own lives. Both girls describe their engaging tasks in science as "interesting" but they do not describe ways in which their activities relate to their lives. Crystal believes she is not personally interested in her bread mold project but that she chose to do this project because it was something "different than what everyone else was doing." Rosa believes her interest in the experiments stems from the fact that they "caught her eye" and that they were "something that is interesting that you've never seen before, something new." Both Crystal and Rosa emphasize interest and novelty as part of the reason they engage in science.

Beth also describes being engaged in a lab examining water bugs for reasons similar to Crystal and Rosa. Beth is interested "to a point." She was interested because she has "never actually seen something in real life like that." Thus in this example Beth also emphasizes novelty of the engaging task.

The types of interest Crystal, Rosa, and Beth describe are consistent with what motivational research terms *situational interest* rather that *individual interest* (Hidi, 1990; Murphy & Alexander, 2000). A situational interest is ephemeral and relates to characteristics of an event within an immediate situation. In contrast, individual interest is deep-seated and built over time and leads to a desire to seek competence and display personal investment within that area. Thus, Crystal and Rosa describe a different way in which their engagement in science is interesting; they describe a situational interest rather than an individual interest or personal relevance. According to Hidi, students who describe a situational interest may be less likely to seek competency in the task, or in this case similar science tasks in the future. Thus types of interest may influence the quality of future motivation and learning.

While Crystal and Rosa do not describe personal relevance to the science task they found engaging, in other contexts they describe engaging in activities that relate to personal *values* and *relationships*. In their favorite subjects, both girls describe engaging because the material relates to relationships with others and because they were able to reflect on their experiences. Crystal describes a paper she wrote about a personal relationship and Rosa describes two projects, an autobiographical project and a heritage project, that helped her reflect on her life and her family. Both girls believe that it is important to learn about their lives and stress the importance of having papers relate to their lives. In fact, both girls describe being less willing to work on projects that do not relate to their lives.

In summary, for these at-risk girls relating to what "I am learning" means a connection with "who I am," "who I am becoming," and "my personal relationships." Clearly seeing themselves in what they are learning is something they value. Cothran and Ennis (1991) discuss how a lack of personal interest can result in disengagement. Conversely, the presence of personal relevance offers an entry point for Beth, Mica, and Thalia in science. Understanding individual interests might not be specific enough to determining the multiple ways students can find relevance. Beth and Thalia's engagement had components consistent with their career goals. Thalia's engagement also pertains directly to her family.

Mica's engagement was congruent with personal beliefs and values about science. Thus the girls do more than talk about relevance as important to their engagement, they describe three different ways science relates to their lives. These types of relevance reflect the degree to which they see themselves, or a future self in relation to science. In this way science becomes a vehicle for learning more about their identity. A clear research goal is to document the types and various ways students find relevance in the sciences; this seems particularly important for at-risk youth who may depend on relevance to engage.

Patterns of Engagement

In addition to describing personal relevance to science, some of girls further describe learning more about themselves in relation to science. Following is a summary of patterns related to extracurricular engagement that provide context for understanding patterns of science engagement.

Each girl shows unique ways she engages in learning science and collectively there were similarities in their patterns of engagement. However, each girl describes key differences in the ways in she finds science personally relevant and what she believes she learned when engaged. When a girl describes learning science that is personally relevant, she also reports learning something in science that is integrated with her sense of self. Thus, seeing themselves in their learning may influence what they learn and the degree to which they believe it is important. In this way the girls seem to engage to learn science for the sake of understanding themselves, not necessarily for understanding science. While this pattern is mirrored in extracurricular engagement, it is does not hold for all girls in science. Following is a description of these patterns and reflections on ways by which sustained motivation and learning may be influenced.

Extracurricular pattern of engagement. In extracurricular activities, each girl reports learning skills, values, and beliefs integrated with her sense of self. What they report learning is generalizable to who they are, who they are becoming, and the importance of personal relationships. Beth reports learning to value teamwork; Mica discusses the importance of learning to communicate with others; Thalia talks about learning teamwork, leadership, and communication skills that help her work with others; Crystal reports learning confidence, competence, and stress management; and Rosa describes learning responsibility applicable to several areas of her life.

Also important is the breadth of their engagement in extracurricular activities. They describe being engaged multiple times and in multiple ways, not just engaged in a specific, singular task. Additionally, they describe multiple ways they find relevance to their learning, global efficacy beliefs, and learning for mastery. Researchers report that high efficacy beliefs and relevance to future goals and careers buffer against negative academic outcomes such as poor grades (Bandura, 1997; McEvoy & Covington, 2001; Shernoff et al., 2001). Furthermore, mastery goal-orientations are also known to be important to engagement and task persistence (Miller et al., 1996). These findings might help explain how engagement is sustained in extracurricular contexts for at-risk girls. This pattern of engagement might imply a positive feedback loop, resulting in the development of skills and knowledge important to identity. In turn, the enhancement of self beliefs might be experienced as motivating, thereby supporting continued engagement.

Integrated Science Engagement. In comparison to extracurricular engagement, the girls differ in the degree to which they describe learning science skills, values, and beliefs as integrated with her sense of self. Beth, Mica, and Thalia describe learning science that is integrated with their identities, while Crystal and Rosa do not.

What Beth, Mica, and Thalia report learning is generalizable to their view of who they are, who they are becoming, and the importance of relationships *as it relates to science*. They each describe adding to their personal beliefs, goals, and values in the sciences. Beth and Thalia describe learning content that relates to their career interests in zoology and psychology, respectively. Furthermore they describe learning that they are more capable in pursuing future goals. Beth believes learning about animals makes her "want to be a zoologist like ten times more." Thalia believes her engagement in the

Down's syndrome project makes her feel more capable in researching disorders as a mom. While Mica does not describe learning content that supports a career goal, she describes learning content that contributes to a personal value in science. She believes that her project taught her to think more about her impact on the environment. Mica translates what she learned into her daily life and makes decisions to recycle materials. Similarly, Beth reports learning content that supports a heightened belief that animals are smart in their own way. In these ways, the girls describe engaging in science to learn more about who they are, who they are becoming, and about relationships or future relationships with others.

The Integrated Science Engagement pattern mirrors characteristics of engagement in extracurricular contexts. Particular similarities relate to personal relevance, learning goals, and the features of what the girls report learning. What differs is the frequency of engagement. However, the similarities between the patterns suggest that girls engaging in Integrated Science Engagement have the potential to engage in continued, intrinsic engagement as in their extracurricular activities. In science, these girls appear to engage *if* they find ways the material is personally relevant. They experience feeling capable in science and pursue intrinsic learning goals. Their engagement bolsters beliefs about who they are and who they can become in relation to science. This pattern of engagement is likely support intrinsic motivation and continued engagement in the sciences. However, the problem is the girls' engagement is focused on *one* science task. Compared to extracurricular engagement, the relative task specificity and frequency of engagement, as well as their less general efficacy beliefs and fewer mastery goal-orientations, might limit their beliefs about who they are and who they can become in science. Finding ways to extend these instances might increase successful experiences and encourage each girl to continue integrating science with her sense of self.

Impersonal Science Engagement. What Crystal and Rosa report learning from being engaged in science differs from the other girls. They report engaging in and learning science but the science skills and beliefs they report are not integrated with their identities. Crystal claims she learned that she was capable of doing "big projects," but not specifically science projects. Rosa believes she learned how to do science experiments and make hypotheses. The tasks they learn, doing big projects and experiments, have little to do with the girls' beliefs about who they are or who they are becoming.

Thus Impersonal Science Engagement differs distinctly from Integrated and Extracurricular patterns of engagement. In science Crystal and Rosa engage without personal relevance, but with a situational interest. They experience feeling capable in science and assume extrinsic and intrinsic learning goals. They report learning skills, but the skills lack an integration of themselves and science. Interestingly, Crystal and Rosa are the two students who have the highest GPA's of the girls. Valuing grades may be beneficial for academic success at the cost of failing to develop skills, values, and believes integrated with science. This cost could be crucial if their motivation is linked solely to a grade rather than to their personal and future goals. Comparing Extracurricular Engagement to Impersonal Science Engagement, highlights the importance of intrinsic learning goals and efficacy beliefs observed when these girls are engaged. Educators should learn to capitalize on these assets. Furthermore, educators need to help at-risk girls identify ways in which science and science tasks are personally relevant; sparking a connection between themselves and science.

Conclusions & Implications

These research findings challenge assumptions educators and researchers have about at-risk girls and their engagement in the science learning. While these girls have difficulty in school, they have high hopes for who they will become. Optimistically they discuss skills they are learning and goals for their futures. Importantly, this study finds ways that at-risk girls engage in learning science. Although they infrequently engage in science, each girl reports being engaged, feeling competent, and expresses a desire to learn at least once in their science classes. Central to understanding science engagement is recognizing

how one's sense of self can be integrated with science. Understanding this relationship depends on understanding multiple motivational factors important to learning engagement among at-risk girls.

This study also questions ways in which learning engagement has typically been studied. It challenges researchers to view youth holistically and to explore how their engagement in other contexts can inform engagement in science learning. While engagement may only reflect a portion of one's experience in science, examining themes and internal motivational factors associated with engagement and comparing these themes with engagement experiences in other contexts yields a clearer conceptualization of the engagement process, laying the foundation for future research.

Understanding extracurricular engagement and modeling it in science is likely to promote sustained engagement instead of sporadic, task-specific engagement in science. If fostering engagement for mastery and development of intrinsic interests in the sciences are important goals, then educational research should focus on (1) understanding personal relevance and (2) building intrinsic goal-orientations and efficacy beliefs rooted in engagement.

This study finds that in extracurricular contexts, and for some girls in science contexts, personal relevance to science offers an entry point for engaging in learning. Common themes highlight how engagement in learning has important links to their lives in terms of (1) beliefs and values, (2) future goals or careers, and (3) relationships with family and friends. These complex and interrelated themes suggest that understanding individual interests alone may not be specific enough to determine the multiple ways through which students find relevance. This is particularly important for at-risk youth for whom personal relevance may be a necessary condition for engaging in science learning.

This finding also highlights the need for educators to identify and support ways in which students find science personally relevant and to build success based on this knowledge. Some students have a narrow perspective of how science material may be personally relevant. For example, some students did not associate health or medicine with science, yet these areas held personal significance in terms of potential career paths. Interestingly, these girls also had mothers who were nurses. The reality is that with failing grades the girls are going to have a difficult time perusing these careers.

In addition to understanding the important role of personal relevance, a focus is needed on other identified internal motivational factors: intrinsic goal-orientations and efficacy beliefs. We need to find ways reinforce intrinsic goal-orientations and to build efficacy beliefs in the process of science learning. This may be particularly challenging for students who are focused on earning a "good" grade or perhaps getting by with a minimal grade. For some, learning was supported by extrinsic motivators. Considering a history of failure, grades provided a method for demonstrating to themselves or others that they *can* earn good grades. For others, there seemed to be almost resistance to seeking "good" grades, leading paradoxically to engagement in learning based almost entirely for intrinsic reasons. These girls describe learning science in terms of learning more about themselves. Regardless of the processes, educators have an opportunity to build intrinsic motivation when these girls are engaged in science learning. Systematic strategies are needed to reinforce the development of intrinsic motivation. This might include, for example, taking time to recognize and discuss the questions formulated by students about experiments, or uncovering ways in which science touches their lives in other contexts outside of the classroom. Further research is needed to understand the development of intrinsic motivation in areas with low efficacy beliefs as well as how intrinsic motivation relates to personal relevance.

As educators we need to not view failure in science as inevitable for high-risk youth. Rather, we need to scrutinize ways that we fail to incorporate science into their lives. We need to question our role as educators and query more carefully our responsibility to each of these girls. The challenge is to develop effective strategies for understanding the interface of one's sense of self and intrinsic interest in science learning. This area of study is uncharted for at-risk girls. The present study provides direction to further a program of study and to develop sound educational practices for enhancing engagement in science learning.

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[1] Names used in this study are pseudonyms.

[2] The phrase *academically at-risk* has been used broadly in a variety of contexts to represent students who struggle in school. Generally speaking, at-risk can be defined as "a category of persons whose personal characteristics, conditions of life, and situational circumstances make it likely that their development and/or education will be less than optimal" (Gordon & Yowell, 1994, p.53). While there are a myriad of reasons why students are in danger of failing out of school, the fact remains that their low-performance in school (and in core subjects such as science) are indicators of risk and potential protective factors for school drop-out. This study does not use the term to refer to an inherent deficit, quite the opposite our study focuses on personal attributes for learning science.

[3] Beth describes science as her favorite subject. In this case, comparisons are only made between her extracurricular context (sports) and science class. In place of examining three learning contexts, I asked Beth to describe two times she was engaged in science class.

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